# Aaditya Datar

*Indian Institute of Science Education and Research, Pune*

*+91 9860036838*
*datar.aaditya@students.iiserpune.ac.in*

## Education

August 2020 (Ongoing) **Indian Institute of Science Education and Research, Pune**, *BS-MS Dual Degree*, $4^{th}$ year Physics Major.
CGPA : 9/10

2018–2020 **Dr. Kalmadi Shamarao Junior College, Pune**, *Subjects: Physics, Chemistry, Mathematics and Computer Science*.
92.46% in Maharashtra State Board Examination (High School Certificate)

Till 2018 **Abhinava Vidyalaya High School, Pune**.
92.80% in Maharashtra State Board Examination (Secondary School Certificate)

## Experience

Summer 2023 **Summer Project**, *Benchmark Positron Scattering Experiments*.
I have been selected as an *ANU-FRT* (Future Research Talent) 2023 Scholar and am currently working under the mentorship of Dr. James Sullivan, Australian National University. I am working on a project which seeks to perform measurements and analysis of positron scattering involving targets of fundamental interest, using a state-of-the-art beamline. The data will be used to test the latest quantum models of low energy scattering. I worked specifically on the biomolecule formic acid. During the course of this project, I

- learned the basic principles of scattering theory, studied the positron beamline to understand how the various components work to so as to set up different types of targets for different types of experiments, and also obtain data from the same.
- Handled various components of the beamline, eg: computer control, vacuum systems, gas handling systems, electronics, etc. to set up multiple scattering experiments on the target, formic acid.
- Analyzed the data obtained to calculate different types of cross sections: elastic differential cross sections (DCS), grand total cross sections (GTCS), etc; and also cross sections of inelastic channels like positronium formation, electronic excitation and ionization. In additon to this, I also coded a simple analysis tool in Python to automate the analysis process for the elastic DCS analysis.

January 2023 **Semester Project**, *Introduction to General Relativity*.

I worked under the mentorship of Dr. Arijit Bhattacharyay, Associate Professor of Physics, IISER Pune for the Spring 2022 semester. In the project, I

- learned the mathematics required to understand General Relativity.
- studied the theory of Special Relativity in the context of geometry, and further studied the field equations of General Relativity
- studied the Schwarzschild solution, and tried to understand Schwarzschild black holes.
- studied the interior solutions to spherically symmetric mass distributions, leading up to the TOV equation.
- read the following paper: *All static spherically symmetric perfect fluid solutions of Einstein's Equations* to further understand how to work with a given source mass distribution that is spherically symmetric.

August 2022 **Semester Project**, *Introduction to Quantum Information and Quantum Computing*.

I worked under the mentorship of Dr. TS Mahesh, Professor of Physics, IISER Pune during the Fall 2022 semester. In the project, I

- learned how to work with composite two-level quantum systems like qubits, and also learning how to use the density operator formalism to study entangled systems.
- learned about entanglement and Bell's inequalities, in the context of spin correlations
- learned the basics of information theory and it's extension to quantum information
- learned basic quantum algorithms

In addition to this, I also read, presented and reproduced the results given in the following paper: *Calculating spin correlations with a quantum computer*. In the context of this presentation, I also learnt IBM's Quantum Experience software (Qiskit) and used it to reproduce results from the aforementioned paper.

Summer 2022 **Summer Project**, *Introduction to High Energy Physics*.

I worked under the mentorship of Dr. Sourabh Dube, Associate Professor of Physics, IISER Pune. In the project, I was tasked with

- familiarizing myself with the fundamentals of the Standard Model and how to work with Feynman diagrams through the provided reading material from textbooks.
- to learn and understand the workings of particle detectors (specifically CMS at CERN); and also how data is collected at CMS.
- to learn the fundamentals of operating the ROOT software framework to plot and analyze data.
- to analyze the data of a certain event dataset; using ROOT, the elementary particles were tagged and identified, plots of variations of various parameters like invariant mass, scattering angles, etc. were made; and the events were identified to be the Drell-Yan and the $t\bar{t}$ pair production processes.

Concurrently, I also read and presented the following papers:

- *Search for microscopic black holes and string balls in final states with leptons and jets with the ATLAS detector at sqrt(s) = 8 TeV*
- *Search for microscopic black holes in a like-sign dimuon final state using large track multiplicity with the ATLAS detector*

## Academic Achievements

May–July 2023 **ANU-FRT Scholar**, *Funded by the Australian National University (ANU), Canberra*.

The *Future Research Talent* (FRT) awards are jointly offered by ANU College of Science, ANU College of Health and Medicine and ANU College of Engineering and Computer Science to students from India; the award includes a scholarship and an opportunity to travel to ANU to pursue collaborative research, for a period of 10-12 weeks, in a range of Science, Health and Medicine disciplines.

August 2020–2025 **DST INSPIRE Scholar**, *Funded by the Department of Science and Technology (DST), Government of India*.
Scholarship awarded to the top 1% meritorious students in India to undertake education in the natural sciences for the duration of their degree courses, based on an academic (CGPA) criterion.

February 2021 **Summer Research Fellowship Program 2022**, *Indian Acadmy of Sciences, Bengaluru*.
Selected for a summer research fellowship through a program organized by the prestigious Indian Academy of Sciences.

December 2021 **Vijyoshi Camp 2021**.
A National Science Camp for select KVPY/INSPIRE fellows. Funded by the Department of Science and Technology (DST), Government of India and hosted by Indian Institute of Science (IISc), Bangalore

September 2020 **Joint Entrance Examination (JEE) Advanced 2020**.
All India Rank (AIR) 4732 out of 160,000 aspirants selected from JEE Mains.

January 2020 **Joint Entrance Examination (JEE) Mains 2020**.
99.66 percentile cumulative score (AIR 3936) out of 1.1 million aspirants.
99.94 percentile score in Physics

## Relevant Courses

August 2023 In Autumn 2023, I will be crediting the following courses in the $4^{th}$ year ($7^{th}$ semester) of my BS-MS Dual Degree course.

- **Nuclear and Particle Physics**
- **Quantum Field Theory**
- **Gravitation**
- **Statistical Mechanics II**
- **Condensed Matter Physics II**
- **Physics Lab V**

January 2023 In Spring 2023, I credited the following courses in the $3^{rd}$ year ($6^{th}$ semester) of my BS-MS Dual Degree course.

- **Quantum Mechanics II**
- **Electrodynamics II**
- **Statistical Mechanics I**
- **Condensed Matter Physics I**
- **Physics Lab IV**

August 2022 In Fall 2022, I credited the following courses in the $3^{rd}$ year ($5^{th}$ semester) of my BS-MS Dual Degree course.

- **Quantum Mechanics I**
- **Electrodynamics I**
- **Electronics I**
- **Optics**
- **Mathematical Methods of Physics II**
- **Economics and Public Policy**

August 2020 – 2022

Some courses that I have covered up till now along with a brief description of the contents.

- **Classical Mechanics**
- **Real Analysis I**
- **Discrete Structures**
- **Group Theory**
- **Mathematical Methods of Physics I**
- **Data Analysis**
- **Introductory Quantum Physics**
- **Calculus II**

## Skills

Programming: Comfortable with C++ and Python

Software: Comfortable with LaTeX, MATLAB, Mathematica, ROOT, Microsoft Word/Excel/Powerpoint

## Languages

English: Fluent

Marathi: Native

Hindi: Native

German: Beginner- "Certificate Course in German" *Goethe-Institut/Max Mueller Bhavan, Pune*

## Extracurricular Activities

December 2022 — **IISER Pune Basketbal team**.
Played for the IISER Pune Basketball team in the Inter-IISER Sports Meet (IISM) 2022, Bhopal

September 2021–2022 — **Quiz Club, IISER Pune**, *Club Coordinator*.
Handled the organization and management of various quizzing events within and outside IISER Pune

September 2021–2022 — **Mimamsa 2022, IISER Pune**, *Physics Question Making Team*.
Part of the Physics Question Making team, for Mimamsa, India's premier science quiz for undergraduates.

September 2021 — **Science Nurture Program (SNP), IISER Pune**, *Volunteer*.
Conducted talks in Physics and Mathematics to popularize science education among high school students